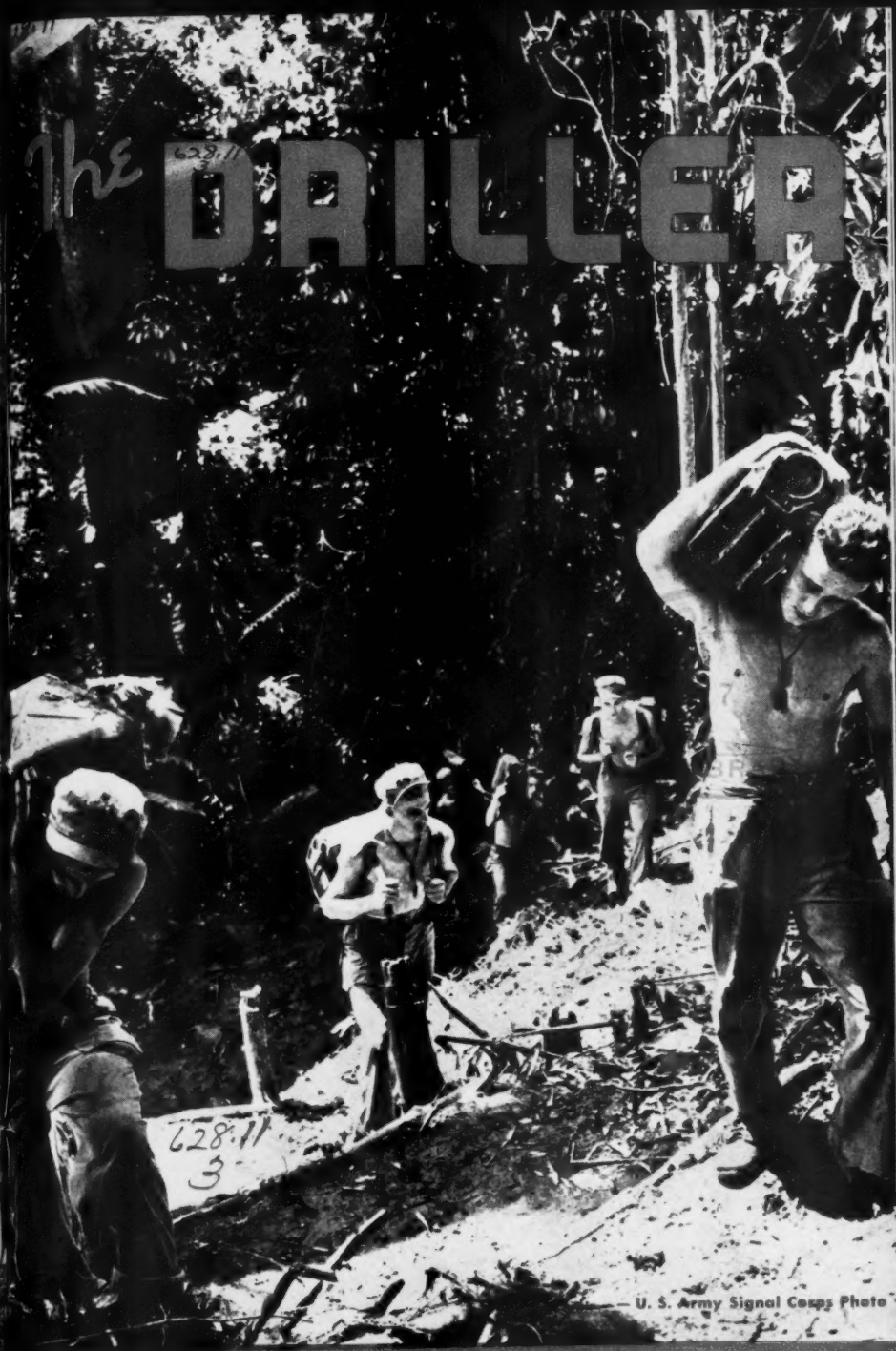
The DRILLER



— U. S. Army Signal Corps Photo

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VOLUME 18 SEPTEMBER, 1944 NUMBER 9

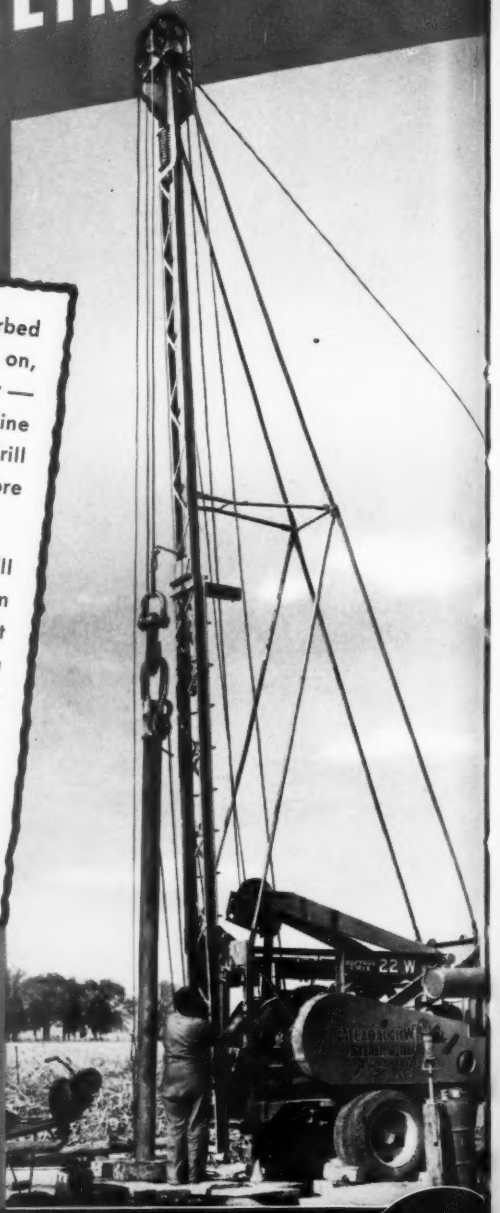
Take a Look at YOUR DRILLING FUTURE

All-steel construction, shock-absorbed drilling, power you can count on, speed, complete mobility, versatility — Bucyrus-Erie water well drills combine the most advanced features of drill design to give you faster, better, more profitable drilling.

That's the kind of equipment you'll need to keep among the leaders in your area when peace returns. Just as Victory is going to the best men with the best fighting equipment, the most in drilling profits will go to contractors who plan NOW to get the best in drilling equipment — Bucyrus-Eries.

So take a look at **your** drilling future — plan it with Bucyrus-Eries!

J-89C



Limited numbers of "All Three" Bucyrus-Eries — 21-W, 22-W, 24-W — will soon be delivered for civilian use. Your promptness in anticipating your needs will help you get your Bucyrus-Erie sooner.

BUCYRUS·ERIE CO.

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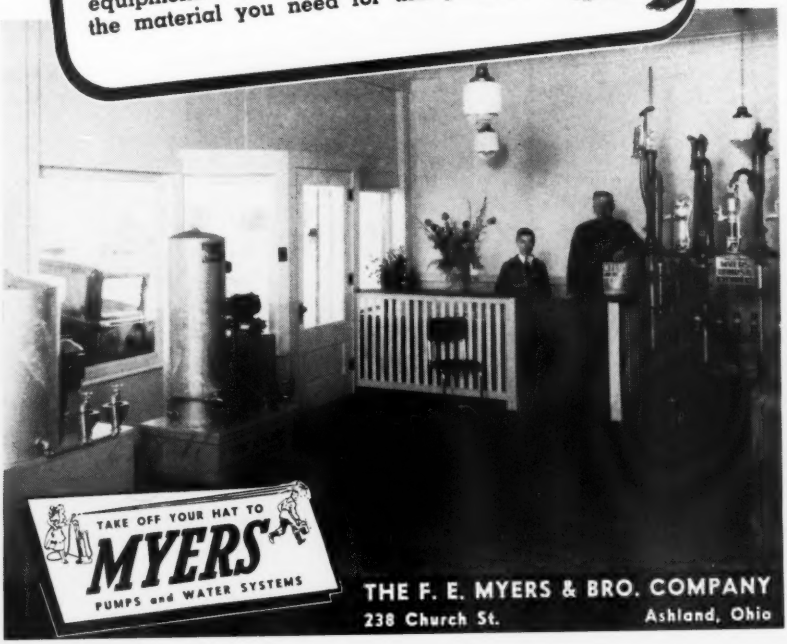
ARMY E

"I LET PEOPLE KNOW *I drill* GOOD WELLS *and sell* GOOD PUMPS"

"After a well is drilled, what people want is pump performance that gives them plenty of water," says Lattie Googins, Missouri driller. "So I make it a point to let people know I'm in the pump business, selling and installing Myers, the equipment they know best for dependable quality and performance. My modern display room has paid me handsomely — in more drilling jobs and more water system sales."

Whether or not you have a display room, you, as a Myers dealer, can let people know, in many effective ways, that you sell and install this leading pumping equipment. Myers furnishes, cost-free, all the material you need for this purpose.

77WS4



TAKE OFF YOUR HAT TO
MYERS
PUMPS and WATER SYSTEMS

THE F. E. MYERS & BRO. COMPANY
238 Church St. Ashland, Ohio

Will There Be Enough Water?

Driller Photo

The eastern half of the country, heretofore complacent about its water supply, now faces the grim fact that underground reserves are dwindling. Illustrations for this article are from THE DRILLER'S files.

By Harold Titus

Reprinted by special permission of the Saturday Evening Post, copyright 1944 by The Curtis Publishing Co.

IN MARCH, 1943, Lester Hoerger, a farmer of Holmes County, Ohio, reeled in his tape and read the bad news that his well had fallen sixteen feet since November. Hoerger was one of a thousand observers of water-table conditions for Ohio's Water Supply Board, and his own well was his county's worst record. Some wells had even risen a bit.

Yet, when the board tabulated all the readings for the year, the figures showed that Ohio's water table had dropped a mean of 3.17 feet in 1943. That made a fall of 100 feet in fifty years for some sections, and neither deficient rainfall nor misuse of land surfaces explained it all.

In February, 1944, W. F. Conrad, water-works superintendent at Bicknell, Indiana, reported disconsolately to the United State Geological Survey's district office that the yield from his wells had gone from 750 to 400 gallons a minute—and he had 5000 folks, four coal mines and a railroad to supply. Again scant rain and excessive runoff were only part of the answer.

In March, the first of fifty-five test wells was sunk near Louisville in a feverish search for more ground water, because known sources for the distilleries were failing and two years of synthetic-rubber production in the new Rubbertown district had knocked the table down twenty-one feet. Again the reason was not wholly failure of normal recharge of natural storage.

The grim fact is that underground sources of water have been dangerously depleted by overuse. The Eastern United States, generally complacent about water resources, despite occasional local trouble, is now facing a condition that increasingly harasses agriculture, domestic life and industry—particularly the new wartime industry which largely forecasts the peacetime industry to come. Wells in Connecticut deepened as water levels fell, are below sea level, and salt intrudes. Memphis is agitating for a state law to regulate wells, because its public supply is menaced by other interests. Mississippi's Gulf Coast wells, which have flowed since man remembers, must now be pumped. Illinois farmers, wells dry, buy water from tank trucks. The problem is no longer local or recognized only by those in difficulty.

Considering the map, dotted with lakes coursed by rivers, this may not make sense. Water is water, isn't it? Surface water, however, is one thing and ground water quite another. If a farm is not on a lake or stream, water must come from the ground. If a town is not near constant surface water or where runoff can be impounded for a reasonable price, it must drill for it. And an industry—well, for a lot of modern industry any old water won't do at all. It must be of certain quality and temperature or else tons of expensive and now critical material must go into treatment plants.

Industry has always used much water, but was not invariably choosy about quality or temperature. It takes, for example, 18,000 gallons of water to produce a ton of ingot steel. Youngstown steel mills use 500,000,000,000 gallons a year, but that is just Mahoning River water. The entire flow is used repeatedly, and, when finally let go, runs a temperature of 130 degrees, but that doesn't matter. Steel, from the hydrologist's point of view, is a rough-and-tumble industry. Synthetic rubber is not. The new rubber plant at Institute, West Virginia, needs 120,000 gallons of cool water every minute. Before an airplane motor goes into military service, up to 150,000 gallons of water, cooler than can be depended on from surface supplies, must be utilized. Modern paper mills need up to 50,000,000 gallons each day, either

• In the West, with ground water still fairly plentiful, well water is used extensively for irrigation.

Fresno County Chamber of Commerce (Calif.) Photo

from the ground or cooled down to sixty degrees. Certain of the new metals must be handled at some stages under air conditioning, and the efficiency of labor is definitely increased when summer air is tempered.

This item of air conditioning has started a lot of brow-furrowing among those whose job it is to keep city mains under pressure. To be sure, not all air-conditioning systems require water, but where natural underground reservoirs are at hand and their temperature does not exceed sixty degrees, cooling air by water is generally the simplest and cheapest method. Two thirds of our public water systems draw from the ground. War interrupted air-conditioning expansion for the general public, but stepped it up in industrial areas, so the total withdrawal for this purpose increased, hydrologists estimate.

Legislation Needed

Demand for air conditioning has caused many Eastern states to recognize the need for ground-water legislation. The more arid West has been conscious of the value of this resource for over half a century, and regulatory measures are common. Until 1933, New Jersey was the only Eastern state with a statute bearing on underground supplies. Elsewhere in the East if you wanted water from the ground all you needed was surface rights. You started punching holes straight down until you found water, and what you did by draining off the neighbor's supply was nobody's business. Not even his.

New York State, in 1933, passed the only other Eastern Act to regulate the development of ground water. This became necessary when withdrawal exceeded natural recharging on Long Island and the water table sank. Now, Long Island had been endowed with abundantly producing wells. For generations, Kings and Queens counties, with relatively heavy population had used ground water, but in recent years only to supplement aqueduct flow from upstate. Nassau and Suffolk counties, farther away from surface supplies and not so rich in taxable resources, had viewed askance any move of their neighbors to pump excessively.

Wells Yielded Salt Water

In the early 30's, too many Long Island wells began yielding salt water, which meant they were overworked. So the state gave regulatory authority over wells to the Water Power and Control Commission, making it mandatory for the prospective driller of a large well to secure approval. In five years, Long Island filed 300 applications. Of these, 204 wells were needed for air conditioning and would draw 2,500,000,000 gallons annually from resources already taxed to the limit.

When industry uses ground water, it is often contaminated; not so when it functions in closed air-conditioning systems. So the commission granted these petitions on the agreement that the water be returned to its natural underground reservoirs after use. Artificial recharging of ground reservoirs was brand-new in the East, but established practice in parts of the West. On Long Island, it consists of drilling a second well though which water is pumped back into the ground. The operation slowed the water-table fall, but has raised the temperature of ground supplies as much as twenty degrees in one extreme case. As this is disastrous for certain uses, obviously there's work yet to be done.

New Haven industry began voluntarily returning water to the ground through recharging wells on a small scale in 1940. At Old Bridge, New Jersey, the Duhernal Water Com-

pany, supplying powder plants and overpumping, stripped top cover from the gravel over its well field and spread the flow of a handy stream across the area, recharging the reservoir by seepage, just as rainfall would do. A number of war plants with open gravel pits or other excavations adjacent are filling them with used but uncontaminated water, which returns by gravity to their well screens. The techniques of the re-use of ground water in most parts of the East, however, remain to be worked out.

Locating ground water for distressed areas is not always simple. The size and nature of these reservoirs, and the hidden avenues by which rainfall finally reaches them, all depend on local geology. Some rocks are impervious. Some porous formations will underlie whole tiers of states, and the only problem is how far down you must drill to penetrate them. Other aquifers—the geologist's term for a water conducting or holding stratum—are small in area and shallow in depth. In some cases, underground formations may be easy to interpret with the information ordinarily available; in others, they baffle the experts.

Ration Water

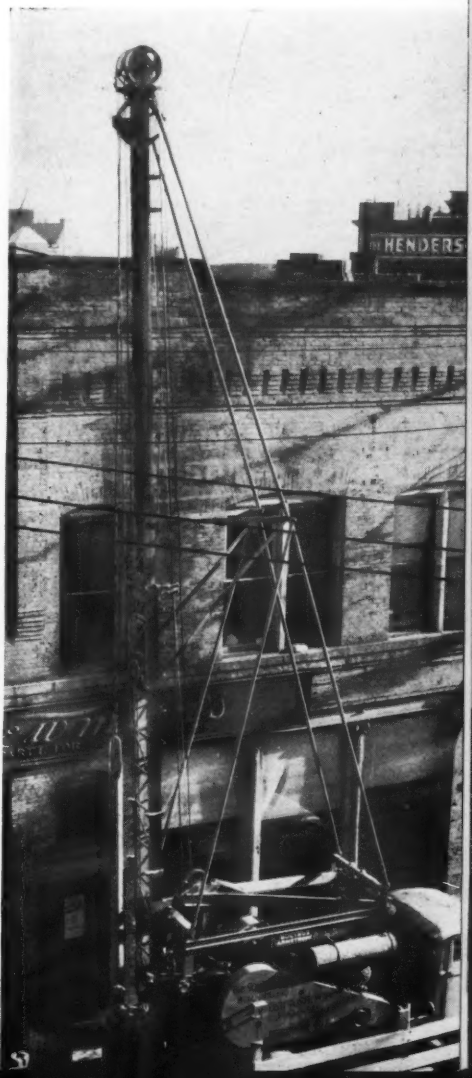
One of those difficult spots is Central Kentucky. Through most of the winter, Bardstown, relying on impounded surface supplies, has rationed water, with pressure completely off for hours at a time. Without rationing, the local distilleries, now making industrial alcohol, could not operate. As soon as the six Geological Survey technicians finish their grim chore of finding ground water for Louisville war industries, they will tackle the Bardstown job.

On the other hand, there was the relatively simple matter of finding proper and sufficient water for the Ford bomber plant at Willow Run. When the location was selected, the city of Detroit agreed to extend its mains a dozen miles and pump from the practically inexhaustible Great Lakes, but when an attempt was made to get the pipe in those hectic

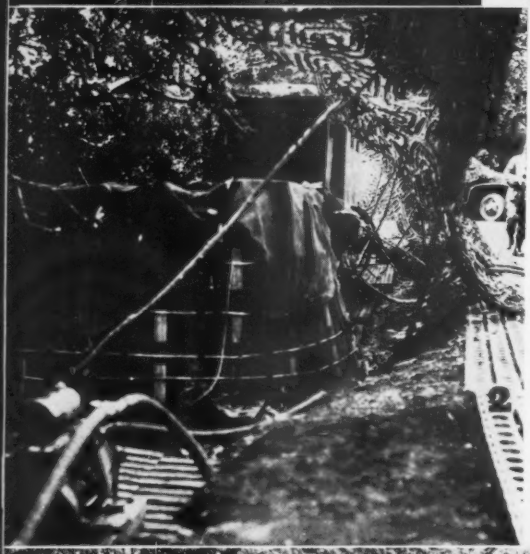
(Continued on Page 18)

• Before the war, air conditioning wells were increasing rapidly. Will declining water tables affect the drilling of post-war wells?

Bucyrus-Erie Co. Photo



Water Supply in the Army

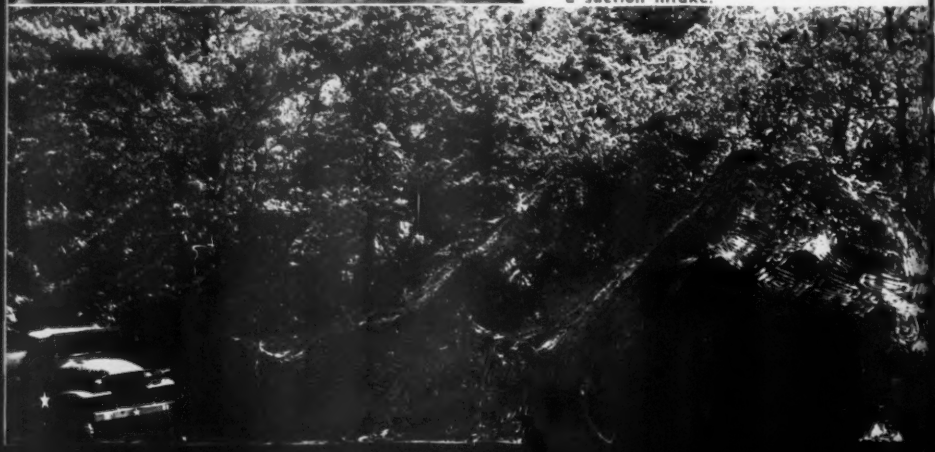


1. This soldier's job, for the moment, is to regulate the flow of water through this mobile purification unit.

2. Carefully concealed under a camouflage net, the units of this water station are a pump, canvas storage tank, and purification truck where water is drawn in for chemical treatment and filtration.

3. Difficult to discern even at close quarters, the water point is effectively camouflaged. A tank truck is shown pulling up to "fill up."

4. Sergeant Harold Knoblich of Sagle, Idaho, in charge of a mobile water supply unit, cleans off the strainer on a suction intake.



5. Breaking a connection for a rotary drill is one of the details handled by these water supply men.

6. Leveling his rig preparatory to drilling for a new supply of water for thirsty fighting men.

All photographs by U. S. Army Signal Corps

Drillers well know the importance of water on the food production front at home. That it's important on the fighting fronts is attested by the careful consideration the Army has given toward obtaining and supplying pure water. The pictures on these pages give you an idea of some of the details involved in doing the job.

The DRILLER

A JOURNAL FOR WATER WELL DRILLERS

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Review Shows Extreme Run-off Variation

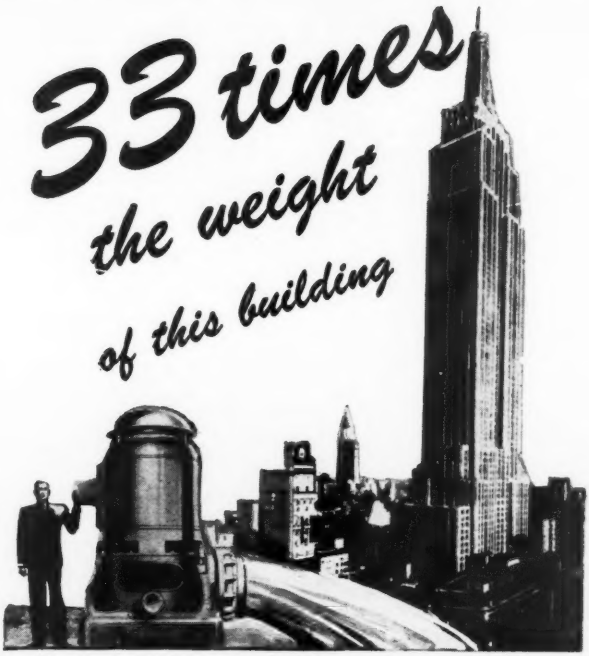
THE month of June was marked by extreme variation in the amount of runoff between different regions throughout the country, according to the Water Resources Review for June issued recently by the Water Resources Branch of the Geological Survey, United States Department of the Interior.

"Floods and droughts marked the month," the Review states. "Floods of destructive magnitude occurred for the third consecutive month in the west-central states. Local floods occurred also in New England, Alberta, Montana, and Utah. Droughts prevailed in eastern Virginia and North Carolina. Noteworthy area of deficiencies in stream flow also occurred in southern Quebec, Ohio River Basin, upper Gila River Basin in Arizona, and in the Columbia River Basin."

The spreading of the drought in the central Appalachians and Atlantic Coastal States, centering in eastern Virginia and North Carolina, was in contrast to the relief from threatening drought conditions in the New England States. The drought area now embraces all, or major parts of 10 States. "Throughout the whole East (excepting central New England) stream flow declined much more than usual for seasonal recession in flow, the decline being most marked in eastern Georgia, the Carolinas and Virginia," the Review states, adding: "Although stream flow averaged 120 per cent of normal in the 10 most affected States during May, it averaged only 65 per cent of normal during June." Drought conditions are "particularly bad" in the Norfolk area of Virginia and are "rapidly becoming serious" in the entire area east of the Blue Ridge, the Review asserts.

Pictured on the Cover . . .

SUPPLYING water the hard way, the Southwest Pacific soldiers shown in the cover picture call on strong backs to carry water through jungles to points where it is needed. The soldiers shown are members of the U. S. Army 37th Infantry Division at Bougainville, in the Solomon Island group. See pages 8 and 9 for additional photos on water supply in the armed forces.



LIFTING 10 MILLION TONS
of water annually

A good pump has to take a lot of punishment. For instance, take an average size Peerless Pump producing 5000 gallons of water per minute, lifting it from a deep well, 75 feet straight up. That's a lift of over 1200 tons per hour. In one year this pump lifts 10,957,000 tons. That's a lot of lifting. No wonder so many cheaply-built pumps fail. It takes a Peerless to stand up under such a load, year after year. Peerless precision is worth the effort. Peerless stamina is insurance of economical pump life.

PEERLESS PUMPS
TURBINE • HI-LIFT • HYDRO-FOIL

PEERLESS PUMP DIVISION *of* ***Food Machinery Corporation***

301 W. Avenue 26, Los Angeles, 31, Calif. ★ 1250 W. Camden Ave., S. W., Canton, 6, Ohio

OTHER FACTORIES: San Jose 5 and Fresno 16, Calif.

NEWS OF THE MONTH

AWWA Elects Newkirk Head

THE 64th Annual Convention of the American Water Works Association, held at Milwaukee June 13th to 16th, was attended by a large number of water works men from all over the United States and Canada.

Held at the Milwaukee Auditorium, technical sessions were divided into general and divisional meetings. Wartime problems and costs of water works structures were stressed.

S. F. Newkirk, Jr., Supt. of the Board of Water Commissioners, Elizabeth, New Jersey, was elected president for 1944-45. The vice-presidency went to L. N. Thompson, General Supt. and Engineer, St. Paul Water Department, St. Paul, Minnesota. Other officers are S. M. Morris, past president; H. E. Jordan, secretary; H. W. Brush, treasurer.

The convention voted to hold its 1945 meeting in St. Louis.

Myers Holds Sales Clinic

TO STIMULATE ideas in creating greater interest, the F. E. Myers & Bro. Co., Ashland, Ohio, instituted a clinic for its salesmen at the plant office in Ashland on June 26 to 30. Preliminary to discussions, men attending the clinic were taken on a tour of the plant. Employing visual education as a means of promoting a better understanding of the subject, slides presenting production machinery were shown, prior to discussion on installation of equipment and service problems.

As a refresher course, the men were reviewed in such topics as merchandising and display, marketing conditions, territory analysis, sales promotion and technique, proper use of advertising in direct sales, and canvassing with jobbers and dealers.

The second half of the clinic program followed the pattern of other wartime conferences in presenting data and detail for 1944-45.

Pomona Offices Moved

THE chief administrative offices of the Pomona Pump Division of the Joshua Hendy Iron Works have been moved to Sunnyvale, California, for consolidation with the general administration of the company.

Among those moving their offices north are Arnold Brown, sales manager; A. W. Moore, advertising manager, and Ralph Lindeman, export manager. All manufacturing activities will continue to be carried on in the Southern California plants at Pomona and Torrance, with Charles L. Barrett as plant manager for both.

Well Known Drill Dristributor Ill

H. C. KAUFMAN of the Kaufman Company, Los Angeles, California, has been hospitalized with a nervous breakdown, according to word received recently. Mr. Kaufman will be confined for an in-

definite period while undergoing treatment, reports indicated.

A. V. Swartz, who has been assistant to Mr. Kaufman, will manage affairs of the company during the latter's illness. The Kaufman Company is distributor for Bucyrus-Erie drilling equipment in California and other southwestern states.

New Production List

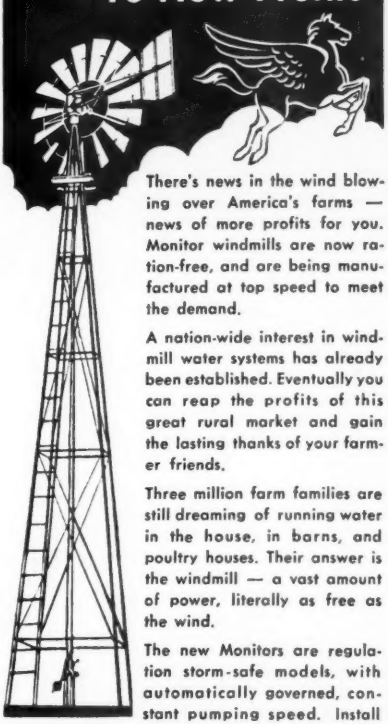
THE F. E. Myers & Bro. Co., Ashland, Ohio, announces that a revised edition of their Wartime Production List is now in the hands of all customers of active record. Distributors have been supplied with quantities for their dealers.

Profusely illustrated, this new Wartime Production List is complete with brief product description, code words, and prices. Its 36 pages cover all Myers products now being manufactured. The book was published primarily for dealers to dispel confusion attendant to using Myers' large full line product catalog under present wartime production restrictions. A letter to the trade, which accompanies the new list, explains allocation of goods and preference ratings. Dealers can sell directly from the simplified list without reference to complete catalogs excepting where sales features and detailed information are desired.

By concentrating production on the most essential and widely accepted items for farm use, Myers has been able to substantially increase volume, and speed deliveries on such equipment as hand and windmill pumps, plunger and ejector type water systems, cylinders, hand and power sprayers, and hay unloading tools, the Myers Co. reports.

A sergeant is a fellow who cusses you out after the army swears you in.

RIDE THE WIND
To New Profits



There's news in the wind blowing over America's farms — news of more profits for you. Monitor windmills are now ration-free, and are being manufactured at top speed to meet the demand.

A nation-wide interest in windmill water systems has already been established. Eventually you can reap the profits of this great rural market and gain the lasting thanks of your farmer friends.

Three million farm families are still dreaming of running water in the house, in barns, and poultry houses. Their answer is the windmill — a vast amount of power, literally as free as the wind.

The new Monitors are regulation storm-safe models, with automatically governed, constant pumping speed. Install new windmills — repair worn ones — on these hundreds of thirsty farms. When war developments permit, and pneumatic tanks and automatic gauges are available, grateful farmers will ask you to attach a complete pressure system.

Monitor
SKY POWER WINDMILLS

WINDMILLS
PUMPS
PUMPJACKS
WELL SUPPLIES

• BRANCHES •
BAKER MFG. CO.: Minneapolis, Minn.; Madison, Wis.; Fort Dodge, Ia.; Cedar Rapids, Ia.; Omaha, Neb.; Kansas City, Mo.; Enid, Okla.; Hutchinson, Kansas
BAKER MFG. LTD., Winnipeg, Canada
AXTELL CO.: Fort Worth, Tex.; Amarillo, Tex.; Lubbock, Tex.; San Angelo, Tex.

BAKER MANUFACTURING CO., EVANSVILLE, WIS.

The Driller & The Law

Driller's Testimony Regarded 'Expert'

IN THE May issue, we briefly pointed out that a well driller is occasionally called into court as an expert witness to aid a jury in determining a fact which is not ascertainable without considering the opinion of one experienced in such matters. We referred to a Pennsylvania case where an artesian well driller of 34 years' experience was held to be qualified to testify to the necessity of locating a well at a certain point to avoid seepage of oil from a near-by pipeline into the water. (Jackson v. United States Pipe Line Co., 325 Pa. 436, 191 Atl. 165.)

Further illustrating how an expert well driller may aid a court in determining a question of cause and effect, we draw attention to the decision rendered by the United States District Court for the Eastern District of Pennsylvania in the case of Richard v. Kaufman, 47 Fed. Supp. 337. In the case the principal question presented was whether stoppage of the flow of water from a spring on plaintiff's land was due to blasting operations conducted by defendants on near-by premises.

Defendants presented witnesses who testified to conditions tending to show that the stoppage in flow could not have been caused by the blasting, because of geological formations. On the other hand, plaintiff, presented as his witness a well driller, whose testimony evidently turned the tide of the legal battle in plaintiff's favor. Holding that the jury were warranted in giving credence to this expert's testimony, the Court said:

"The defendant's attack on the admissibility of the testimony of Mark Biery as an expert goes to the weight to be given his testimony rather than to his qualifications. Biery testified that in his opinion the diminution of the flow of water in plaintiff's spring resulted from the blasting. He was a well driller with 35 years' experience in dynamiting. The facts on cross-examination revealed that he had no experience in blasting tunnels, that his blasting experience was with dynamite charges of twice the strength of that used by the defendants, and that he had made no inspection of the plaintiff's spring or the surrounding terrain. This did not disqualify him from expressing an opinion as an expert on whether the blasting in the present case was the cause of the drying up of the spring."

Arthur L. H. Street

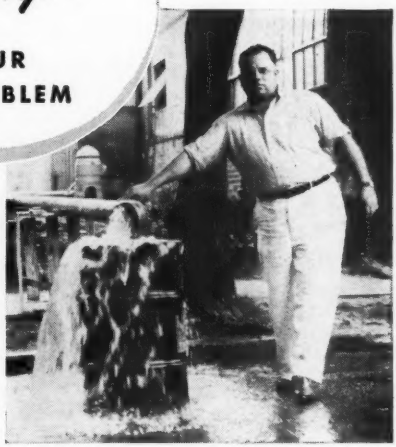
London Water

IN 1236 lead pipe was used to bring water into the city of London and a more imposing lead conduit was begun in 1285. By 1720 every street in London had its water mains and in 1745, castiron pipe was used. In 1787, the first steam pump was used for water systems. Filtering was first attempted in 1839 and it was about this time that the old Corliss walking-beam pumps, standing as high as a house and with cylinders six feet in diameter, were installed. They are still running, with brass parts shining like mirrors! In 1855, filtration of Thames water was made compulsory.

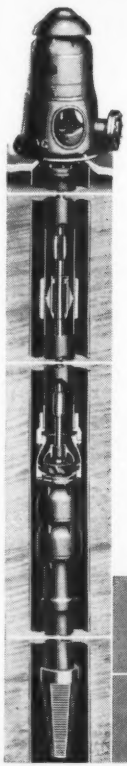
—Byron Jackson Co.
"Byjac News"

Deming Pumps

HAVE SOLVED OUR WATER SUPPLY PROBLEM



(above) The modern plant of Smith's Sanitary Dairy, Doylestown, Pa., (at right) Mr. Harry Smith testing one of their deep wells.



SMITH'S SANITARY DAIRY OF DOYLESTOWN, PA., PRAISE DEMING WATER LUBRICATED TURBINE PUMPS

SANITATION — 100%! is the policy and the practice at Smith's Sanitary Dairy, where large scale production of dairy products demands constant washing of machinery and cleaning operations. Huge quantities of water are required.

Several years ago, the company had two deep wells drilled and two oil-lubricated pumps of a well-known make installed. Serious trouble developed when oil from the pumps contaminated the water supply.

At this point, the company heard, for the first time, about Deming *Water Lubricated* Deep Well Turbine Pumps. Two new wells were drilled and Deming Turbines were installed. Another unit was installed on a nearby farm purchased by the company.

After more than six years experience with the Deming Pumps, Mr. Harry Smith said:

"We want to tell you that we are greatly pleased with the splendid service these pumps have rendered for us. Our plant uses vast quantities of water and we are glad to say that the Deming *Water Lubricated* Turbine Pumps have solved our water supply problem."

That's the kind of satisfied customers Deming Pumps help YOU, as a well driller, to obtain. *Sell DEMING!*

DEMING

THE COMPLETE LINE

PUMPS AND WATER SYSTEMS

The Deming Company · Salem, Ohio

WIT BITS

Tigers had been ravaging a village and the terror-stricken natives sent for the nearest white man to assist them. This man was a crack shot, and had never been known to miss. His method was to tie a goat to the foot of a tree at dusk, climb the tree, and when the tigers came for the goat, fire at the flash of their eyes. In the morning they would be found dead, shot straight between the eyes.

He followed his usual procedure the first night, but although he fired several shots, when the day dawned the goat was gone but there were no dead tigers.

This happened on two succeeding nights. Perturbed, he took a huge torch with him on the fourth night, instead of firing at the flashing eyes, switched on his torch and saw to his amazement six tigers advancing in pairs, each with one eye closed.

Inscription on a water tank at Emory University:

Emory College 1850
It was founded and organized by
our beloved
Pres. John Billings
Born 1815
Died 1870
Capacity 150,000 Gallons

Insurance man putting questions to a cowboy: "Ever had any accidents?"

"No," was the reply.

"Never had any accident in your life?"

"Nope, a rattler bit me once, though."

"Well, don't you call that an accident?"

"No. He bit me on purpose."

The curfew tolls the knell of
parting day;
A line of cars winds slowly
o'er the lea;
A pedestrian plods his
absent-minded way,
And leaves the world quite
unexpectedly.

Four Marines were playing bridge in a hut on Wake Island. Suddenly another leatherneck burst into the room and shouted: "Say, fellows, two hundred Japs have just landed on the beach." The players looked at each other for a minute, and finally one of them said: "Never mind, you guys, I'll go this time. I'm dummy anyhow."

A stranger in the town paused to watch a merry-go-round operating on a vacant lot. Most of the customers were happy children, but his attention was drawn to a miserable looking old man riding one of the wooden horses. What struck him as strange was that every time the merry-go-round stopped, the little old man made no attempt to get off. He continued to sit on the horse, wearing a most unhappy expression. At length curiosity overcame the stranger, and when next the man on the horse stopped opposite him he said: "Pardon me, sir, but do you enjoy going round and round like this?"

"Not a doggone bit!" snapped the old man.

"Then why do you do it?"

"Bill Hoskins, the guy that owns this dadburned thingumajig—drat his ornery hide!—he owes me $5, and this is the only way I can get it out of him."

In Line for Victory

COOK Well Strainers hold back sand and let in water from sand and gravel strata at camps, air fields, proving grounds, munition plants, ordnance works and war defense factories.

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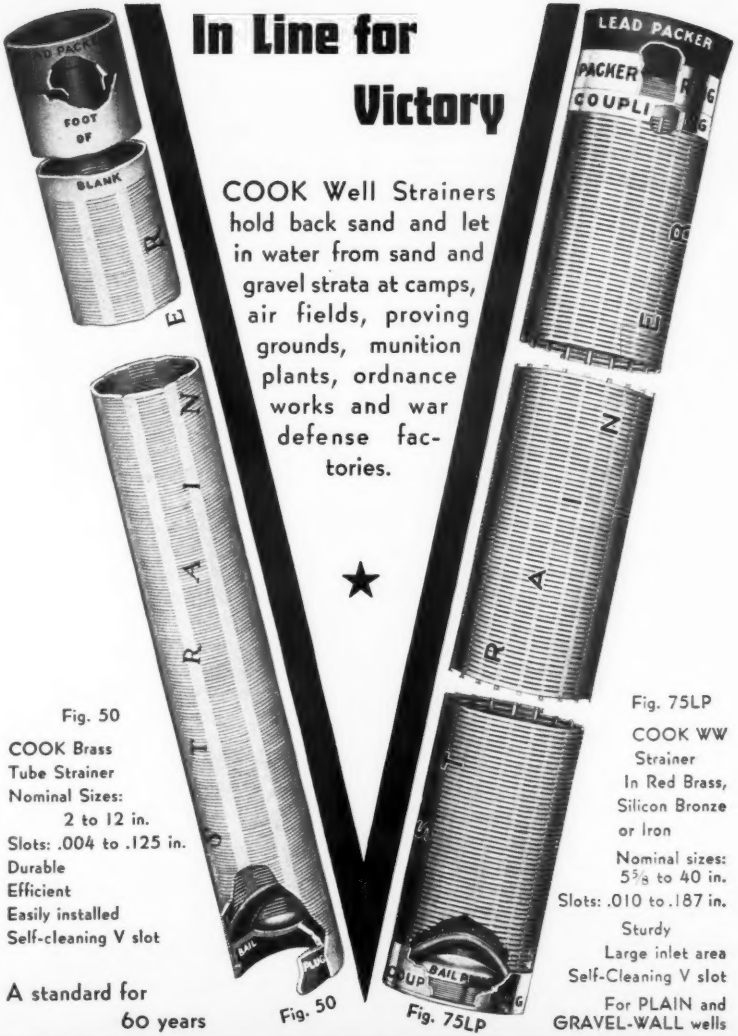

Fig. 50

COOK Brass Tube Strainer
Nominal Sizes:
2 to 12 in.
Slots: .004 to .125 in.
Durable
Efficient
Easily installed
Self-cleaning V slot

A standard for 60 years

Fig. 50

Fig. 75LP

Fig. 75LP

COOK WW Strainer
In Red Brass, Silicon Bronze or Iron
Nominal sizes: $5\frac{5}{8}$ to 40 in.
Slots: .010 to .187 in.
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DEEP-WELL COOK PUMPS

Enough Water? . . .

(Continued from Page 7)

days of 1940, this plan promptly flattened out.

So Ford engineers began combing the neighborhood for a source. The near-by Huron River wouldn't do without treatment, and up bobbed those critical materials again. Farmers and well drillers in the vicinity —normally a source of highly valuable information—agreed that a moderate water supply could be obtained as far down as a black shale, ninety feet beneath the surface. But under the shale, they said were traces of gas, and in some places the gas was even sulphurous.

Suggests Location

So Ford appealed to R. A. Smith, state geologist, and Smith called in O. F. Poindexter, a staff man who for years had been assembling information on Michigan formations. Poindexter knew that in one glacial period Lake Erie had been nearly 100 feet lower than it is now. He knew that the Huron River emptied into Lake Erie at that time and coursed through glacial deposits to get there. So the old bed, far below the present bottom, must have filled with material which makes a choice aquifer.

"Drill alongside the river," he told the Ford people. "You should find silt, then gravel and, finally, boulders. They should hold water."

They did—nearly 4000 gallons a minute at eighty-seven feet through a twenty-four-inch casing. Other wells raised pumpage to 10,000,000 gallons a day, and Willow Run was out of water difficulties.

But once the supply is located, up jumps the management problem. An example of how ground water may be handled rests in recent history of Mill Creek and Miami River valleys, north of Cincinnati. The steady fall of Ohio's water table is an old story, but the repeated droughts of the 30's made many a Buckeye for the first time miss the water because his well was dry. Back in 1883, the Procter and Gamble plant had flowing wells. By 1938 they were pumping ninety feet, and new drillings were made annually to replace those petering out. Other plants had identical woes. Mill Creek's flow could be impounded, but its volume was insufficient for all needs and its temperature varied from thirty-two degrees on winter mornings to eighty-five or more in dog days. Local paper mills and chemical plants could not meet such fluctuations. So down went more wells and on down went the water level.

In February, 1944, David H. Harker, of the Ohio Water Supply Board—a body established in 1941 to study water problems and suggest action—told a postwar planning conference in Columbus that though the state's water table was down because of scant rainfall, it was excessively low in Mill Creek Valley because industry had taken 50 to 100 per cent more than the aquifer could stand.

Demand Increases

Then in came more war industries, among them the huge plant of the Wright Aeronautical Corporation, needing a tremendous volume of water not higher than sixty degrees. So the United States Geological Survey was asked for help, and dispatched two young geologists, Fred H. Klaer and Raphael G. Kanzmann, to work with engineers already on the job.

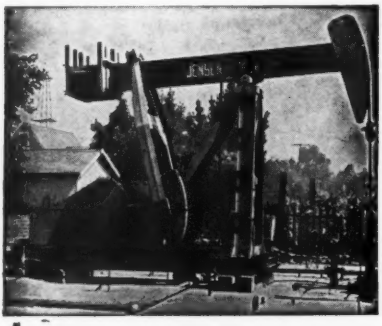
It was soon determined that more water could not be taken from Mill Creek Valley without inviting disaster. But twenty miles away was the Miami River Valley, underlaid by deep and extensive gravel deposits, and already yielding 25,000,000 gal-

lons daily to the city of Hamilton and its industries. The geologists and engineers began looking that way, and great was Hamiltonian consternation. Mill Creek was about to rob the Miami River Valley, and what would the home folks do? There was plenty of precedent for such misgivings.

Not only to reassure Hamilton but to be certain they could get what they needed became the first objective of the lads on the job. So Klaer and Kanzmann laid out a dozen test wells south of Hamilton, combed precipitation records for the area, measured the amount of recharge afforded by rainfall and by the Miami River itself—a technical legerdemain which is a story in itself—and satisfied the Wright Corporation and Hamilton that the natural recharge was such that the new plane plant could have 15,000,000 gallons every twenty-four hours without menacing anybody. Wright got it—via concrete pipe line—and the Miami River Valley water table is holding right up there. The released but unpublished report of this investigation may set a pattern for a lot of future ground-water development.

New Status for Hydrologists

These widespread Eastern troubles began coming to light in the 30's. Repeated droughts of that decade were the first severe and protracted ones since industry came of age. Now with wartime industrial needs depleting the water supply, and with another drought at least starting, hydrologists have come out of relative obscurity to assume the status of bright and shining knights. The United States Geological Survey, a steady, old-fashioned agency which all these years has plugged along



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without the aid of a public-relations division, has the spotlight in countless troubled localities, but, as yet, is too busy to take any bows.

Its ground-water men have been drawn in from Western posts where problems are less urgent. The Survey is spending $1,000,000 a year in co-operative investigations with states—the states matching funds. For many years some co-operative work has been in progress, but until the last decade the ground-water phase occupied a small place in most Eastern states. Some, however, like Pennsylvania, have carried on and accumulated excellent data.

Turning around on such a problem involves time. Hundreds of test wells must be periodically observed; some must be drilled. Information on formation must be extended and refined, and the experiences of water suppliers and users ransacked. Indiana is nicely off on a ten-year program costing $60,000 annually.

"In ten years," says Don M. Corbett, the Survey's district engineer, "Indiana should know where its ground water is stored, how great is the natural supply and how much it may safely yield as precipitation varies. That is, Indiana should get these answers in ten years if the available staff can get time to do anything but help folks meet emergencies. That's one of our big jobs now."

Prefer Streamflow Records

Emergencies may be due to multiply because this past winter's precipitation in the East was far below what it should be to recharge these aquifers. The Geological Survey does not rely on rainfall records as an index of the amount of water coming to earth. It prefers streamflow records because such data better reflect precipitation over entire basins. And stream flow began to fall below normal last autumn. Rivers in Mississippi were from 15 to 24 per cent below normal in August, establishing all-time records. Indiana streams were down as much as 50 per cent. Ohio's even lower. Kentucky, Illinois, Pennsylvania and New York were off. Even Maine established a record low of 16 per cent of normal stream flow in January.

The volume of water running down these rivers, when related to precipitation, indicates to the Survey the amount of natural recharging to be expected in ground reservoirs. So the chap you may see dangling from a cable over some river, intent on the movement of a queer device immersed below him, or the lad on a bridge, earphones in place, and manipulating an outlandish gadget in the current, may be getting an answer for some harried factory manager away off in another

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state. What those delicate instruments tell about the quantity of moving water, added to what is known about the detail of local geological structures, can mean either the green light or the warning signal for specific factories whose very life blood today is water.

The whole situation may ease some at the war's end. Then geologists predict, it will mount again. Air conditioning has only started; new production processes demanding water will be introduced in many plants. Cooling towers and purifying devices, which will help, can and no doubt will be extensively used, but, even so, better management of ground water is urgently needed.

I walked an Indianapolis street not long ago with Charles Bechert, the Indiana Conservation Department's state engineer. We were talking about the water table in that area, which has fallen over fifteen feet in recent years. He told me that Indianapolis institutions which use air conditioning mostly drill their own wells because the municipal supply is not cold enough.

"What becomes of the water then?" I asked.

"Down the sewer," replied Bechert, and looked definitely pained. It is an expression many hydrologists wear these days.

"With adequate knowledge of ground-water resources," says O. E. Meinzer, chief of ground-water investigations for United States Geological Survey, "must come effective legal control in every state. In the present emergency, heavy drafts are unavoidable, but everyone must be on the alert to prevent depletion. In the future, there must be insistence upon control which, with full conservation and development, will make ground-water supplies perennially secure."

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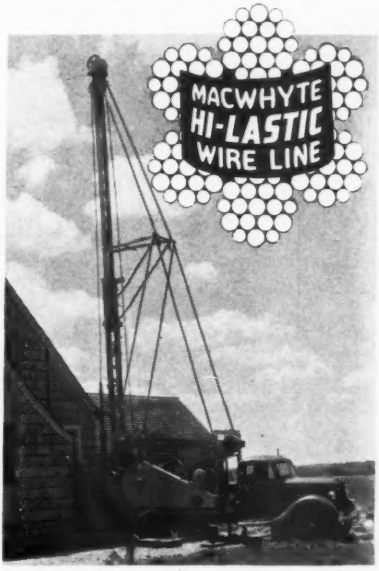

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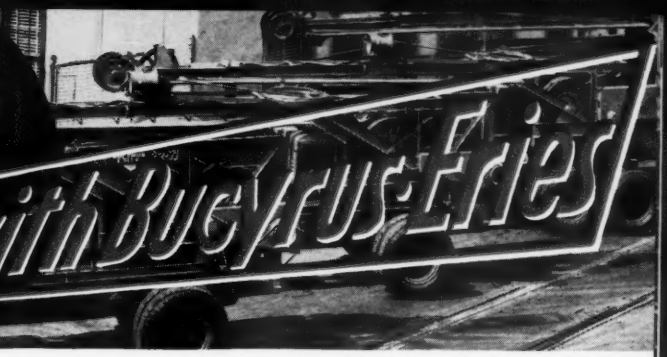

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